General

Guideline Title

British Thoracic Society guidelines for the management of community acquired pneumonia in children: update 2011.

Bibliographic Source(s)

Harris M, Clark J, Coote N, Fletcher P, Harnden A, McKean M, Thomson A, British Thoracic Society Standards of Care Committee. British Thoracic Society guidelines for the management of community acquired pneumonia in children: update 2011. Thorax. 2011 Oct;66(Suppl 2):ii1-23. [200 references] PubMed

Guideline Status

This is the current release of the guideline.

This guideline updates a previous version: British Thoracic Society Standards of Care Committee. British Thoracic Society guidelines for the management of community acquired pneumonia in childhood. Thorax. 2002 May;57(Suppl 1):i1-24.

Recommendations

Major Recommendations

The grade of the recommendation (A+, A-, B+, B-, C, D) and the level of evidence (Ia, Ib, II, III, IVa, IVb) are defined at the end of the "Major Recommendations" field.

Clinical Features

- Bacterial pneumonia should be considered in children when there is persistent or repetitive fever >38.5 ºC together with chest recession and a raised respiratory rate. [D]

Investigations

- Chest radiography should not be considered a routine investigation in children thought to have community acquired pneumonia (CAP). [A-]
- Children with signs and symptoms of pneumonia who are not admitted to hospital should not have a chest x-ray. [A-]
- A lateral x-ray should not be performed routinely. [B-]
- Acute phase reactants are not of clinical utility in distinguishing viral from bacterial infections and should not be tested routinely. [A-]
- C reactive protein is not useful in the management of uncomplicated pneumonia and should not be measured routinely. [A+]
- Microbiological diagnosis should be attempted in children with severe pneumonia sufficient to require paediatric intensive care admission, or those with complications of CAP. [C]
- Microbiological investigations should not be considered routinely in those with milder disease or those treated in the community. [C]

- Microbiological methods used should include:
  - Blood culture [C]
  - Nasopharyngeal secretions and/or nasal swabs for viral detection by polymerase chain reaction (PCR) and/or immunofluorescence [C]
  - Acute and convalescent serology for respiratory viruses *Mycoplasma* and *Chlamydia* [B+]
  - If present, pleural fluid should be sent for microscopy, culture, pneumococcal antigen detection and/or PCR. [C]
  - Urinary pneumococcal antigen detection should not be done in young children. [C]

Severity Assessment

- For a child in the community, re-consultation to the general practitioner with persistent fever or parental concern about persistent fever should prompt consideration of CAP. [D]
- Children with CAP in the community or in hospital should be reassessed if symptoms persist and/or they are not responding to treatment. [D]
- Children who have oxygen saturations <92% should be referred to hospital for assessment and management. [B+]
- Auscultation revealing absent breath sounds with a dull percussion note should raise the possibility of a pneumonia complicated by effusion and should trigger a referral to hospital. [B-]
- A child in hospital should be reassessed medically if there is persistence of fever 48 h after initiation of treatment, increased work of breathing or if the child is becoming distressed or agitated. [D]

General Management

- Families of children who are well enough to be cared for at home should be given information on managing fever, preventing dehydration and identifying any deterioration. [D]
- Patients whose oxygen saturation is ≤92% while breathing air should be treated with oxygen given by nasal cannulae, high flow delivery device, head box or face mask to maintain oxygen saturation >92%. [B]
- Nasogastric tubes may compromise breathing and should therefore be avoided in severely ill children and especially in infants with small nasal passages. If use cannot be avoided, the smallest tube should be passed down the smallest nostril. [D]
- Plasma sodium, potassium, urea and/or creatinine should be measured at baseline and at least daily when on intravenous fluids. [C]
- Chest physiotherapy is not beneficial and should not be performed in children with pneumonia. [A-]

Antibiotic Management

- All children with a clear clinical diagnosis of pneumonia should receive antibiotics as bacterial and viral pneumonia cannot reliably be distinguished from each other. [C]
- Children aged <2 years presenting with mild symptoms of lower respiratory tract infection do not usually have pneumonia and need not be treated with antibiotics but should be reviewed if symptoms persist. A history of conjugate pneumococcal vaccination gives greater confidence to this decision. [C]
- Amoxicillin is recommended as first choice for oral antibiotic therapy in all children because it is effective against the majority of pathogens which cause CAP in this group, is well tolerated and cheap. Alternatives are co-amoxiclav, cefaclor, erythromycin, azithromycin and clarithromycin. [B]
- Macrolide antibiotics may be added at any age if there is no response to first-line empirical therapy. [D]
- Macrolide antibiotics should be used if either mycoplasma or chlamydia pneumonia is suspected or in very severe disease. [D]
- In pneumonia associated with influenza, co-amoxiclav is recommended. [D]
- Antibiotics administered orally are safe and effective for children presenting with even severe CAP and are recommended. [A+]
- Intravenous antibiotics should be used in the treatment of pneumonia in children when the child is unable to tolerate oral fluids or absorb oral antibiotics (e.g., because of vomiting) or presents with signs of septicaemia or complicated pneumonia. [D]
- Recommended intravenous antibiotics for severe pneumonia include amoxicillin, co-amoxiclav, cefuroxime and cefotaxime or ceftriaxone. These can be rationalised if a microbiological diagnosis is made. [D]
- In a patient who is receiving intravenous antibiotic therapy for the treatment of CAP, oral treatment should be considered if there is clear evidence of improvement. [D]

Complications

- If a child remains feverish or unwell 48 h after treatment has commenced, re-evaluation should be performed with consideration given to possible complications. [D]
- Children with severe pneumonia, empyema and lung abscesses should be followed up after discharge until they have recovered completely

and their chest x-ray has returned to near normal. [D]

Follow-up

- Follow-up radiography is not required in those who were previously healthy and who are recovering well, but should be considered in those with a round pneumonia, collapse or persisting symptoms. [B+]

Definitions:

Brief Description of the Generic Levels of Evidence and Guideline Statement Grades Used

Evidence Level	Definition	Guideline Statement Grade
Ia	A good recent systematic review of studies designed to answer the question of interest	A+
Ib	One or more rigorous studies designed to answer the question, but not formally combined	A-
II	One or more prospective clinical studies which illuminate, but do not rigorously answer, the question	B+
III	One or more retrospective clinical studies which illuminate, but do not rigorously answer, the question	B-
IVa	Formal combination of expert views	C
IVb	Other information	D

Clinical Algorithm(s)

None provided

Scope

Disease/Condition(s)

Community acquired pneumonia

Guideline Category

Diagnosis

Evaluation

Management

Prevention

Treatment

Clinical Specialty

Family Practice

Infectious Diseases

Internal Medicine

Pediatrics

Pulmonary Medicine

Intended Users

Advanced Practice Nurses

Nurses

Physician Assistants

Physicians

Respiratory Care Practitioners

Guideline Objective(s)

To provide evidence-based recommendations for the management of community acquired pneumonia in children

Target Population

Infants and children in the United Kingdom (UK) with community acquired pneumonia (CAP) or suspected CAP

Note: These guidelines do not include neonates, infants with respiratory syncytial virus bronchiolitis or children with upper respiratory tract infection, mild fever and wheeze. The specific management of children with pre-existing respiratory disease or that of opportunistic pneumonias in immunosuppressed children is not addressed.

Interventions and Practices Considered

Assessment/Diagnosis

1. Assessment of signs and symptoms
2. Microbiological investigations
    - Blood culture
    - Viral detection by polymerase chain reaction (PCR) and/or immunofluorescence nasopharyngeal secretions
    - Acute and convalescent serology for respiratory viruses *Mycoplasma* and *Chlamydia*
    - Microscopy, culture, pneumococcal antigen detection and/or PCR of pleural fluid if present
3. Plasma sodium, potassium, urea and/or creatinine
4. Assessment of severity
    - Consultation with general practitioner (for child in the community)
    - Reassessment as indicated
    - Referral to hospital
    - Chest auscultation

Management/Treatment

1. Provision of information to families managing children at home
2. Oxygen
3. Avoidance of nasogastric tube if possible
4. Oral or intravenous antibiotic therapy (amoxicillin, co-amoxiclav, cefaclor, erythromycin, azithromycin, clarithromycin, macrolides)
5. Re-evaluation and consideration of complications
6. Follow up after discharge

Note: Chest physiotherapy, routine chest radiography, and measurement of acute phase reactants and C-reactive protein were considered but not

recommended.

Major Outcomes Considered

- Sensitivity and specificity of diagnostic tests
- Symptom improvement
- Morbidity and mortality
- Pneumonia rates

Methodology

Methods Used to Collect/Select the Evidence

Searches of Electronic Databases

Description of Methods Used to Collect/Select the Evidence

Identification of Evidence

A search strategy was developed by an information specialist from the Centre for Reviews and Dissemination in York (part of the National Institute for Health Research). The search strategy and the results are shown in Appendix 1 in the online supplement of the original guideline document (see the "Availability of Companion Documents" field).

The Cochrane Library (DARE and Cochrane Database of Systematic Reviews), MEDLINE and EMBASE were searched from 2000 onwards. There were some technical changes made to the original search strategies to reduce the chances of missing studies: a single search strategy was used rather than separate strategies for each subject. Studies were limited to English language in view of the limitations on time and resources.

Two thousand and seventy-six studies were identified by the searches, which were rerun in July 2010. The updated search identified a further 511 titles.

Assessing the Literature

Initial review of the 2076 titles and abstracts was undertaken by one reviewer, screening for relevance. This was repeated after the second search by another reviewer. The relevant titles and abstracts were grouped by subject matter with many papers being relevant for more than one subject area.

Two reviewers then assessed the studies for inclusion. Studies from countries where the populations or clinical practices were very different from the United Kingdom (UK) were excluded unless they addressed questions that could be generalised to the UK (such as clinical assessment). Any differences of opinion were settled by a third party.

Number of Source Documents

Not stated

Methods Used to Assess the Quality and Strength of the Evidence

Weighting According to a Rating Scheme (Scheme Given)

Rating Scheme for the Strength of the Evidence

See the "Rating Scheme for the Strength of the Recommendations" field.

Methods Used to Analyze the Evidence

Review of Published Meta-Analyses

Systematic Review with Evidence Tables

Description of the Methods Used to Analyze the Evidence

Assessing the Literature

The studies were appraised using the Cochrane data extraction template (see Appendix 2 in online supplement in the original guideline document [see the "Availability of Companion Document" field]).

Any guideline statements made were graded using the same table as that used by the group developing the adult guidelines (see the "Rating Scheme for the Strength of the Recommendations " field). First, each paper was given an evidence level (Ia to IVb) by the authors of each chapter. Then, at the end of each chapter when evidence statements were collated, a summative evidence level was attached to each statement depending on the level of evidence underpinning that statement.

Methods Used to Formulate the Recommendations

Expert Consensus

Description of Methods Used to Formulate the Recommendations

The guideline development group was set up by the British Thoracic Society (BTS) Standards of Care Committee and comprised two paediatricians with a special interest in respiratory disease, a paediatrician with a special interest in paediatric infectious diseases, a general paediatrician with a special interest in ambulatory paediatrics, a specialist trainee in paediatrics, a general practitioner with an interest in childhood infection and a paediatric pharmacist. An information specialist developed the search strategy and ran the searches.

Each recommendation was graded (A to D) based upon a considered judgement of the body of evidence (see the "Rating Scheme for the Strength of the Recommendations" field).

Rating Scheme for the Strength of the Recommendations

Brief Description of the Generic Levels of Evidence and Guideline Statement Grades Used

Evidence Level	Definition	Guideline Statement Grade
Ia	A good recent systematic review of studies designed to answer the question of interest	A+
Ib	One or more rigorous studies designed to answer the question, but not formally combined	A-
II	One or more prospective clinical studies which illuminate, but do not rigorously answer, the question	B+
III	One or more retrospective clinical studies which illuminate, but do not rigorously answer, the question	B-
IVa	Formal combination of expert views	C
IVb	Other information	D

Cost Analysis

What Are the Economic Consequences of CAP in Children?

A number of recent studies have examined the economic costs of CAP. An Italian study of 99 children hospitalised with pneumonia in 1999 calculated the costs of hospital management. The mean cost per patient was €1435 (£1289), increasing to €2553 (£2294) in those treated solely with intravenous antibiotics. The costs were reduced to €1218 (£1094) in those switched to the oral route after 24 to 48 h and to €1066 (£958) in those treated exclusively with oral antibiotics.

In the PRI.DE study of infants and children up to 36 months of age with lower respiratory tract infection, economic resource data were collected. A total of 1329 cases in primary care and 2039 hospitalised cases were analysed. For those classified as pneumonia, direct medical costs were €85 (£76) per office-based case and €2306 (£2072) per hospitalised case. Parental costs amounted to a further €53 (£47) per office-based case and €118 (£106) per hospitalised case. In an Israeli study, further information on indirect family costs for a child with CAP such as days of work missed, travel costs to primary/secondary cared amounted to 976 Israeli shekels (£161) for hospitalised patients, 747 (£123) for those seen at emergency facilities and 448 (£73) for those seen in primary care.

Resource use data were routinely collected in the North of England CAP study 2001-2 (J Clark, personal communication, 2009). This included preadmission GP visits, antibiotics prescribed in the community and in hospital, and number of days of hospital care including any intensive care. Standard NHS list cost data were applied and inflated to 2005/6 levels. The average cost per admitted patient (n = 636) was £2857. The mean cost for severe pneumonia was £3513 (mean hospital stay 5.5 days), falling to £2325 in moderate (hospital stay 4.7 days) and £909 in mild cases (hospital stay 1.7 days). Hospitalisation (non-intensive care) costs accounted for 70% of the total with a further 25% accounted for by intensive care stays. Cost analysis has also been performed on the PIVOT trial, a randomised controlled equivalence trial that demonstrated therapeutic equivalence for oral amoxicillin and intravenous benzyl penicillin in children admitted to hospital. The average costs to the health service were lower at £1410 for intravenous treatment and £937 for oral treatment, demonstrating cost savings of £473 to £518 per child when oral amoxicillin was used.

Overall, therefore, the potential annual direct medical costs of children aged 0 to 16 years admitted to hospital in the UK with pneumonia are £12,000 to £18,000/10,000 per annum. According to the Office for National Statistics (2007) the UK population aged 0 to 16 years is 11.509 million. Therefore, £13 million to £20 million per annum is spent on children with CAP admitted to hospital. In addition, there are direct costs to families and indirect costs to the economy from parental time off work.

Method of Guideline Validation

Internal Peer Review

Description of Method of Guideline Validation

Provenance and Peer Review

The draft guideline was made available online for public consultation (January/February 2011). The draft guideline was reviewed by the British Thoracic Society (BTS) Standards of Care Committee (July 2010/March 2011).

Evidence Supporting the Recommendations

Type of Evidence Supporting the Recommendations

The type of supporting evidence is identified and graded for each recommendation (see the "Major Recommendations" field).

Benefits/Harms of Implementing the Guideline Recommendations

Potential Benefits

Accurate diagnosis and appropriate management of community acquired pneumonia (CAP) in children to improve outcomes and reduce

inappropriate hospital admissions and the associated morbidity and costs

Potential Harms

- The use of X-rays should be balanced against the exposure of children to radiation.
- Nasogastric tubes may compromise breathing and should therefore be avoided in severely ill children and especially in infants with small nasal passages. If use cannot be avoided, the smallest tube should be passed down the smallest nostril.
- Patients who are vomiting or who are severely ill may require intravenous fluids and electrolyte monitoring. Attention is drawn to the 2007 National Patient Safety Agency alert 'Reducing the risk of hyponatraemia when administering intravenous fluids to children'. Serum levels of sodium can be low in children with pneumonia and there is debate as to whether this is related to inappropriate antidiuretic hormone secretion or overall sodium depletion.
- Resistance to antibiotics among bacterial pathogens is increasing and is of concern; an important factor in this increase is the overuse of antibiotics.
- Increased macrolide use is associated with pneumococcal and group A streptococcal resistance and bacteria may acquire macrolide resistance very fast if used indiscriminately.
- Cefaclor has an association with skin reactions.

Implementation of the Guideline

Description of Implementation Strategy

An implementation strategy was not provided.

Implementation Tools

Audit Criteria/Indicators

For information about availability, see the *Availability of Companion Documents* and *Patient Resources* fields below.

Institute of Medicine (IOM) National Healthcare Quality Report Categories

IOM Care Need

Getting Better

Staying Healthy

IOM Domain

Effectiveness

Identifying Information and Availability

Bibliographic Source(s)

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Adaptation

Not applicable: The guideline was not adapted from another source.

Date Released

2002 May (revised 2011 Oct)

Guideline Developer(s)

British Thoracic Society - Medical Specialty Society

Source(s) of Funding

British Thoracic Society

Guideline Committee

British Thoracic Society Standards of Care Committee

Composition of Group That Authored the Guideline

Committee Members: Michael Harris, Oxford Children's Hospital, The John Radcliffe, Headington, Oxford, UK; Julia Clark, Department of Paediatric Immunology and Infectious Diseases, Old COPD, Great North Children's Hospital, Royal Victoria Infirmary, Newcastle upon Tyne, UK; Nicky Coote, Children's Ambulatory Unit, Hammersmith Hospital, Imperial College Healthcare NHS Trust, London, UK; Penny Fletcher, Pharmacy Department, Imperial College Healthcare NHS Trust, St Mary's Hospital, London, UK; Anthony Harnden, Department of Primary Health Care, University of Oxford, Headington, Oxford, UK; Michael McKean, Department of Paediatric Respiratory Medicine, Royal Victoria Infirmary, Newcastle; Anne Thomson, Oxford Children's Hospital, The John Radcliffe, Headington, Oxford, UK

Financial Disclosures/Conflicts of Interest

None

Guideline Status

This is the current release of the guideline.

This guideline updates a previous version: British Thoracic Society Standards of Care Committee. British Thoracic Society guidelines for the management of community acquired pneumonia in childhood. Thorax. 2002 May;57(Suppl 1):i1-24.

Guideline Availability

Electronic copies: Available from the British Thoracic Society Web site .

Availability of Companion Documents

The following are available:

- Appendix 1: BTS community acquired pneumonia in children search write-up. Electronic copies: Available in Portable Document Format (PDF) from the British Thoracic Society (BTS) Web site .
- Appendix 2: Template data collection form for extracting study characteristics and study design items for risk of bias assessment. Electronic copies: Available in PDF from the BTS Web site .

An audit tool is available to registered users from the BTS Web site .

Patient Resources

None available

NGC Status

This NGC summary was completed by ECRI Institute on August 17, 2012.The information was verified by the guideline developer on September 6, 2012.

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